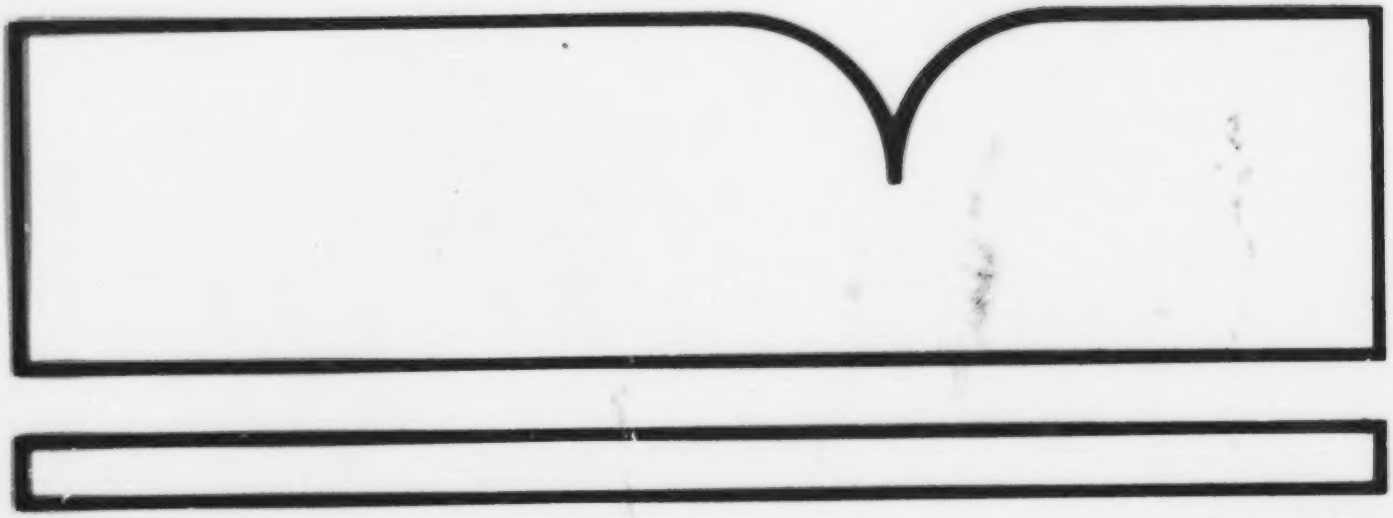
PB84-144088

EPA (Environmental Protection Agency) Evaluation of the HYDRO-VAC Device under Section 511 of the Motor Vehicle Information and Cost Savings Act

(U.S.) Environmental Protection Agency
Ann Arbor, MI

Aug 83



U.S. Department of Commerce
National Technical Information Service
NTIS

EPA-AA-TEB-511-83-12

PB84-144088

EPA Evaluation of the HYDRO-VAC Device Under Section 511 of the Motor Vehicle Information and Cost Savings Act

by

Stanley L. Syria

August 1983

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Test and Evaluation Branch
Emission Control Technology Divison
Office of Mobile Sources
U.S. Environmental Protection Agency

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-AA-TEB-511-83-12		PB84 144088

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12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED Technical
	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This document announces the conclusions of the EPA evaluation of the "HYDRO-VAC device under section 511 of the Motor Vehicle Information and Cost Savings Act.

The evaluation of the "HYDRO-VAC" device was conducted upon the application of the manufacturer. The product is claimed to improved fuel economy and performance for both gasoline and diesel fueled vehicles.

EPA fully considered all of the information submitted by the applicant. The evaluation of the HYDRO-VAC device was based on that information and EPA's engineering judgement. The applicant failed to submit adequate information and data which would substantiate his claims for the device. EPA has evaluted several similar products and none were found to casue significant benefits. For these reasons, EPA has no technical basis to support the claims made for the device or to continue the evaluation on its own.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Automobiles Fuel Consumption Tests	Air Bleed Devices Fuel Economy Gas Saving Devices	

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
	unclassified	21
Release Unlimited	20. SECURITY CLASS *(This page)* unclassified	22. PRICE

EPA Form 2220-1 (9-73)

EPA Evaluation of the HYDRO-VAC Device Under Section 511 of the Motor Vehicle Information and Cost Savings Act

The Motor Vehicle Information and Cost Savings Act requires that EPA evaluate fuel economy retrofit devices and publish a summary of each evaluation in the Federal Register.

EPA evaluations are originated upon the application of any manufacturer of a retrofit device, upon the request of the Federal Trade Commission, or upon the motion of the EPA Administrator. These studies are designed to determine whether the retrofit device increases fuel economy and to determine whether the representations made with respect to the device are accurate. The results of such studies are set forth in a series of reports, of which this is one.

The evaluation of the "HYDRO-VAC" device was conducted upon the application of the manufacturer. The product is claimed to improve fuel economy and performance for both gasoline and diesel fueled vehicles. It is classified by EPA as a vapor-air bleed device.

1. Title:

   Application for Evaluation of HYDRO-VAC Under Section 511 of the Motor Vehicle Information and Cost Savings Act

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The information contained in sections two through five which follow, was supplied by the applicant.

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2. Identification Information:

   a. Marketing Identification of the Product:

      HYDRO-VAC

   b. Inventor and Patent Protection:

      (1) Inventor

      James T. Griffin
      7005 Mapleridge
      Bellaire, TX 77401

      (2) Patent

      "Have not applied for a patent yet"

c. Applicant:

(1) Name and address

James T. Griffin
Griffin Sales Co., Inc.
7005 Mapleridge
P.O. Box 1627
Bellaire, TX 77401

(2) Principals

James T. Griffin, President
Gregory O. Griffin, Vice President

(3) [James Griffin is authorized to represent Griffin Sales Co., Inc. in communication with EPA.]

d. Manufacturer of the Product:

(1) Name and address

James T. Griffin
Griffin Sales Company, Inc.
7005 Mapleridge
P.O. Box 1627
Bellaire, TX 77401

(2) Principals

James T. Griffin, President
Gregory O. Griffin, Vice President

3. Description of Product:

a. Purpose:

"To increase miles per gallon and improve performance of automobiles and light trucks, either gasoline or diesel fueled."

b. Applicability:

(1) Vehicles

"Types of vehicles for which the HYDRO-VAC may be used include, but not limited to, any automobile or light truck, gasoline or diesel fueled: any number of cylinders, any make, model, year, engine size, ignition type, carburetion, and type of transmission is satisfactory. Engine must have some kind of vacuum system, preferably manifold vacuum. No adjustments required. The regulating valve of the HYDRO-VAC unit makes it adaptable to all sizes of engines, for example, 4-cylinder Volkswagen engines to 500 cu. inch Cadillac V-8 engine.

"In freezing weather the HYDRO-VAC reservoir, which contains water, should be protected from freezing by the addition of methanol alcohol, gas additive or gas anti-freeze. Usually, 1 to 2 ounces per pint of water in the reservoir will prevent freezing down to zero degrees F."

c. Theory of Operation:

"Air-water vapor is drawn into the intake manifold by vacuum through the air intake tube which extends to bottom of water reservoir. The air bubbles up through the water creating an air-water vapor. This vapor enters the firing chambers through the intake manifold. Here the vapor turns into steam from the high temperatures produced there when the engine is running. The vapor, upon turning into steam, multiplies itself many times in volume instantaneously at time of fuel-air detonation, helping to create the energy necessary to push the piston down. At this time some of the heat (B.T.U.s) from the engine is utilized to produce useful energy which results in more miles per gallon and more produced horsepower. Water usage is approximately one (1) pint per 400 to 500 miles. Extra miles per gallon will vary from one car to another, but can be calculated through tests. Increase in miles per gallon may also be gradual over several tanks full of fuel. Tests have proven from 10% to 20% increase in miles per gallon."

d. Construction and Operation:

"See literature, installation instructions, schematic, and sample HYDRO-VAC unit enclosed." [Attachments A and B of this evaluation]

e. Specific Claims for the Product:

"The HYDRO-VAC unit has proven through thousands of miles of testing and research and development to increase miles per gallon from 10% to 20%, and improve pe formance on both gasoline and diesel fueled vehicles. For example: 1978 Cadillac DeVille 4-door sedan, 425 cu. in. V-8 engine, gasoline fuel, 4-bbl carburetor, automatic transmission, same driving conditions:

	Without HYDRO-VAC	With HYDRO-VAC
Ending Miles:	39,342	44,318
Start Miles:	39,165	44,087
Net Miles Driven:	177	231
Gasoline Used-Gallons:	17.1	19
Net Miles Per Gallon:	10.35	12.6

Percent of increase in MPG with HYDRO-VAC: +21.74%.

Visual inspection of spark plugs reveals the removal of carbon deposits, and we assume the removal of carbon from the firing chambers for the same reason."

f. Cost And Marketing Information:

"Suggested retail price is $50.00 per each HYDRO-VAC unit, plus installation charges. Ease of installation as shown by the instructions indicates that many users could install the HYDRO-VAC unit themselves."

4. Product Installation, Operation, Safety and Maintenance:

a. Installation - Instructions, Equipment, and Skills Required:

"See Installation Instructions enclosed [Attachment B]. The only tool required is [a] pocket knife or cutting instrument with which to cut the rubber vacuum tubing, and the ability to locate an existing vacuum tube in which to insert the Insert-T."

b. Operation:

"See Instructions enclosed and par. 3.c., page 2."

c. Effects on Vehicle Safety:

"There are no safety hazards to be encountered whether the HYDRO-VAC unit works or not. Should the unit fail to function properly, i.e., shuts off completely or runs out of water, the engine should continue to run without any adverse effect except the user would not be receiving the benefits of the HYDRO-VAC."

d. Maintenance:

"The only maintenance required is to replenish the water in the reservoir, approximately one (1) pint of water per 400 to 500 miles, and protect the unit from freezing during winter months. See par 3.b. (2), page -2-." [3.b.(1) of this evaluation].

5. Effects on Emissions and Fuel Economy:

a. Unregulated Emissions:

"Unknown"

b. Regulated Emissions and Fuel Economy:

(1) "Emissions: Unknown."

(2) "Fuel economy: See par. 3.e above, page -3-."

The following Sections are EPA's analysis and conclusions for the device.

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6. Analysis

EPA evaluated the application and found no problems with the information regarding device identification, purpose, description, construction, cost, operation, vehicle safety, and maintenance.

With respect to the information given in the balance of the application, EPA has the following concerns.

a. The applicant states the HYDRO-VAC device is applicable to "gasoline or diesel fueled engines" and that the "engine must have some kind of vacuum system." Because diesel engines do not have an inherent vacuum source, the applicant was asked to explain how the device functions on diesel engines (Attachment C). The applicant responded (Attachment D) that he connected the device to a vacuum line which discharges into the air intake manifold. Because the applicant's explanation was not sufficiently detailed, EPA is yet uncertain how the device is able to function on diesel engines.

   The applicant also states the device is applicable to any make, model, and engine (with a vacuum source). While it may be true that the device can be adapted to any engine, it does not necessarily mean benefits will be realized. For example, if benefits can be achieved with the device, they could be in part attributable to the enleanment of the air-fuel mixture due to the bleeding of air by the device. Although the device may be installed on late model vehicles having feedback emission control systems, these systems can automatically compensate for the enleanment and thereby negate any fuel economy or emission benefits that are due to enleanment.

b. Based on the information submitted, the theory of operation was judged to be adequate with respect to EPA being able to develop an understanding of how the device is designed and is supposed to function. It appears the device is a vapor-air bleed device which meters varying amounts of air and water vapor into the engine's induction system. Thus, this device differs from injection systems which pump water as a liquid into the engine's intake system.

The applicant's theory of operation is that the inducted vapor turns into steam which multiplies itself many times in volume, thereby helping to push the piston down. He also states that at the same time, some of the heat from the engine is utilized to produce useful energy which results in improved fuel economy and power. The applicant does not mention what impact the addition of air may have on the combustion process.

In EPA's judgment there is considerable question that this device will produce the benefits claimed or that any benefits are achieved for the theoretical reasons outlined by the applicant. The amount of water vapor introduced by this device is very small; too small to likely produce a significant effect on the combustion process. Some other devices that introduce larger amounts of "liquid" water in conjunction with adjustments in engine parameters have produced modest improvements in fuel economy. In that situation the larger amount of water lessens the engine's tendency to detonate and permits operation at a more advanced ignition timing setting, which results in improved fuel economy. Water injection at these higher rates lowers oxides of nitrogen emissions but when ignition timing is advanced to improve fuel economy, a major portion of the oxides of nitrogen reduction may be lost.

There are two generally accepted concepts as to why water injection reduces oxides of nitrogen and lowers the fuel octane requirement of the engine. One theory maintains that in the combustion process, the inert water molecules intersperse among the molecules of fuel and oxygen and make it more difficult for the fuel and oxygen to get together for combustion. The speed of the reaction is thereby decreased lowering the peak combustion temperature and lessening the tendency to detonate or form oxides of nitrogen. The second theory maintains that as the water vaporizes in the combustion chamber the fuel/air mixture is cooled which ultimately results in a lower peak combustion temperature. In any case, the end result is less detonation and lower oxides of nitrogen.

In a recent study, it was found that the addition of significant amounts of water as liquid caused essentially no change in fuel economy.[1] If the water is vaporized prior to entry into the combustion chamber, there will be even less benefit for two reasons. First, the vapor displaces some of the oxygen which

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1 Bruce D. Peters and Russell F. Stebar, "Water-Gasoline Fuels -- Their Effect on Spark Ignition Engine Emissions and Performances", General Motors Corporation Research Labs, SAE Paper 760547, June 1976.

decreases the volumetric efficiency. Second, because the water is already vaporized, there is little evaporative cooling of the fuel/air charge and there is little benefit from the cooling phenomenon discussed above. During World War II water (as liquid) injection was used on aircraft to improve takeoff performance. In this situation a large amount of water lowered cylinder head temperatures and permitted takeoffs at higher intake manifold boost pressures. The increased takeoff power was due to an increased quantity of fuel/air charge that resulted from the higher boost pressure, not due to the water injection itself.

There is a popular concept that introducing water in any quantity and any form is beneficial to the operation of an internal combustion engine. As a result many vapor injection or steam injection devices have been submitted to EPA for evaluation. In most cases the amount of water introduced is insignificantly small. Regrettably, none of the vapor devices produced significant benefits and only one water injection device produced fuel economy benefits and that was at the expense of increased emissions.

c. Fuel economy and performance benefits are claimed for the device in this evaluation although the applicant did not submit adequate substantiating data for any of the claims. The applicant was requested to submit additional test data to support his claims and EPA also provided a recommended test plan (Attachment B). However, the applicant did not respond to EPA's request. Because the device is capable of leaning the air-fuel mixture, it may cause fuel economy benefits for some vehicles. This would be more noticeable on older gasoline-fueled vehicles with richer air-fuel mixture calibrations than on more recent models which are calibrated very lean and/or have feedback emission control systems. EPA has evaluated several vapor-air bleed devices of various designs applicable to gasoline-fueled engines and none were found to cause significant benefits. EPA expects even less benefit with diesel engines because they have leaner air-fuel mixtures than gasoline engines. Thus, EPA has no technical reason for expecting significant benefits when using the HYDRO-VAC device.

d. The installation instructions (Attachment B) were not clear as to whether manifold and/or ported vacuum signals should be used to operate the device. Another concern is that the distributor vacuum advance line is suggested as being an acceptable point to tap into for the operating vacuum signal. Because the device does bleed air, it can only weaken the signal sensed by the distributor vacuum advance unit, and consequently the timing will not advance properly. Because vacuum advance can have a significant impact on fuel economy during cruise operation, the device may have an adverse effect on fuel economy benefits for some engines.

Another concern is that a purchaser who locates a vacuum source when the engine is cold, installs the device, and observes bubbles and turbulence in the fluid reservoir (checkout procedure recommended by instructions), may find the device does not function when the engine is at operating temperature. The reason for this is that inline temperature sensors are used extensively on today's engines for purposes of modifying the signal. Thus, it is important the selection of the vacuum line be done when the engine is at operating temperature.

The applicant was asked about these concerns (Attachment C). He responded (Attachment D) that the device would work on either ported or manifold vacuum, but would give better results on the latter. He also stated that on the vehicles he tested, he did not have to reset the timing because of the device being attached to the distributor vacuum line. EPA is still of the opinion that tapping into the distributor vacuum line can only have an adverse effect on timing and fuel economy. The applicant did not address the temperature sensor issue. Attached to the applicant's letter are revised installation instructions with improved statements regarding the selection of vacuum lines. The revised instructions could be further improved by stating that vacuum line selection should be made with the engine at operating temperature.

e. The applicant states the impact on unregulated emissions is unknown. Based on the design of the device, EPA does not expect any impact on unregulated emissions.

f. The applicant did not submit test data in accordance with the Federal Test Procedures and the Highway Fuel Economy Test. These two test procedures are the primary ones recognized by EPA for evaluation of fuel economy and emissions for light-duty vehicles.* The applicant was requested (Attachment E) to submit additional data to support his claims but he did not respond. Eventually, he notified EPA he could not fund the required testing at this time and that he did not want to proceed any further into the evaluation. Thus, EPA has no data which support the claims made for the device.

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*The requirement for test data following these procedures is stated in the policy documents that EPA sends to each potential applicant. EPA requires duplicate test sequences before and after installation of the device on a minimum of two vehicles. A test sequence consists of a cold start FTP plus a HFET or, as a simplified alternative, a hot start LA-4 plus a HFET. Other data which have been collected in accordance with other standardized procedures are acceptable as supplemental data in EPA's preliminary evaluation of a device.

List of Attachments

Attachment A	Copy of device advertising brochure.
Attachment B	Copy of installation instructions.
Attachment C	Copy of letter from EPA to Griffin Sales Company, Inc., January 20, 1983.
Attachment D	Copy of letter from Griffin Sales Company, Inc., to EPA, January 28, 1983.
Attachment E	Copy of letter from EPA to Griffin Sales Company, Inc., February 22, 1983.

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MORE MILES PER GALLON IMPROVE PERFORMANCE SAVE DOLLARS

H Y D R O - V A C S Y S T E M

An adaption of water induction system used on World War II aircraft engines to increase power. Designed to increase miles per gallon and inprove performance of your car and/or truck engine. Reports indicate 10% to 20% increase in miles per gallon.

OTHER BENEFITS ARE:

1. Saves money on fuel and maintenance cost.
2. Low initial cost.
3. Lasts the life of your engine.
4. Easy to install and maintain.
5. Can be used on engines fueled with gasoline or diesel.
6. Is 100% safe.
7. Produces more horsepower from your engine.
8. Promotes more efficient burning of fuel-air mixture.
9. Reduces "dieseling".
10. Spark plugs stay cleaner longer.
11. Can be moved from one vehicle to another.

WARRANTY: You mu be satisfied. Should you for any reason not be satisfied with the increase in MPG or performance within 60 days from date of purchase, return the complete HYDRO-VAC unit to your dealer for full refund of purchase price. Guaranteed against defects in material & workmanship for period of one year from date of purchase. Warrant is restricted to the replacement of the entire unit or any component part thereof. No other warranty is expressed or implied.

HOW THE HYDRO-VAC SYSTEM WORKS:
Water-air mixture is introduced into the firing chambers through the vacuum system of your engine. The fuel-air mixture of your engine is cooled by the HYDRO-VAC vapor thereby causing the fuel-air mixture to become more dense. Upon entering the firing chamber and being detonated, the expansion of the gases is greater, thereby producing more horsepower which results in more miles per gallon.

The unique regulating valve (patent pending) regulates the amount of vapor introduced into the firing chambers in the correct amount by the modulating devise which partially closes on high vacuum (low R.P.M.'s) when less fuel is required) and opens wide on moderate vacuum (higher R.P.M.'s when more fuel is required). The net result is more miles per gallon and better performance from your engine.

SOLD BY: GRIFFIN SALES COMPANY, Inc., P.O. Box 1627, Bellaire, Tx. 77401.

PRICE: _____

NAME: _____

ADDRESS: _____

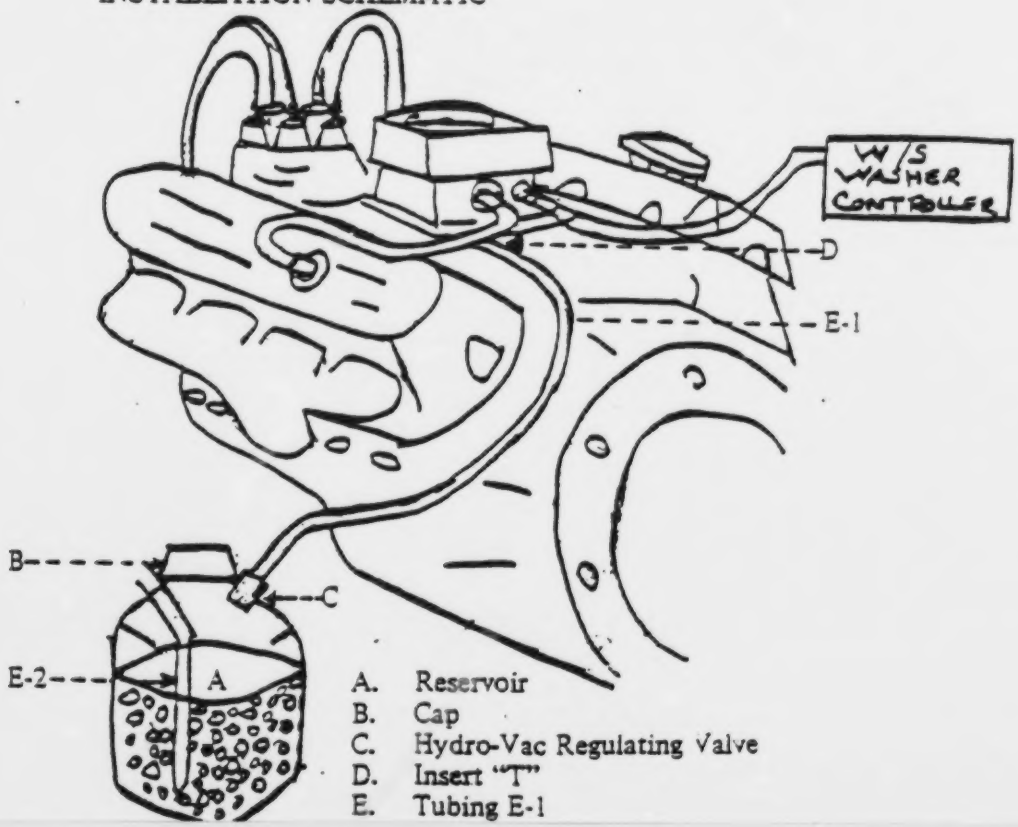
CITY, STATE, ZIP: _____

H Y D R O - V A C S Y S T E M

INSTALLATION INSTRUCTIONS: See Installation Schematic below.

1. Install reservoir (Fig.A) in suitable place in engine compartment of vehicle where reservoir will not be damaged by heat and/or moving parts such as fan belts or pulleys. Secure in a convenient place w[illegible] cord provided for easy maintenance of solution.
2. Locate vacuum line source. The PCV vacuum line or the distributor vacuum advance line is an excellent choice. Cut the line selected and insert the plastic tee (Fig. D). Cut vacuum tube E-1 to required length, removing any excess tubing, and connect to tee (Fig. D). Secure tubing from moving belts & pulleys and hot areas.
3. Remove cap and fill reservoir to fill line using approximately four (4) pints of water. Replace cap for air-tight seal. Your engine should use approximately one (1) pint of water every 400 to 500 miles depending upon size of engine, temperature, humidity, and barometric pressure. CAUTION: DO NOT OVERFILL. Water must be below intake of the modulating valve (Fig. C).
4. Start engine and inspect reservoir. Many bubbles and turbulance should be forming in the reservoir solution and is indication thst the HYDRO-VAC unit is working properly. If bubbles and turbulance do not appear in the solution, this is indication that you have no vacuum on the line or you have a vacuum leak. Check installation procedure to make certain you have vacuum and do not have vacuum leak.
5. MAINTENANCE: Check reservoir periodically at start. When solution reaches ADD LINE, add one (1) pint of water to FILL LINE. During freezing temperatures, add methanol to the water to protect system from freezing.
6. Methanol (Wood Alcohol) is gas additive or gas anti-freeze and is sold by many service stations; auto parts stores or service centers, drug and grocery stores.

HYDRO VAC SYSTEM
INSTALLATION SCHEMATIC



A. Reservoir
B. Cap
C. Hydro-Vac Regulating Valve
D. Insert "T"
E. Tubing E-1

ATTACHMENT C

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ANN ARBOR, MICHIGAN 48105

January 20, 1983

OFFICE OF
AIR, NOISE AND RADIATION

Mr. James T. Griffin, President
Griffin Sales Company, Inc.
P. O. Box 1627
Bellaire, TX 77401

Dear Mr. Griffin:

We have performed a preliminary review of your December 31, 1982 application for an EPA evaluation of the "HYDRO-VAC" retrofit device. We have the following concerns:

1. Section 3.b.(1) of your application states that the HYDRO-VAC device is applicable to "gasoline or diesel fueled engines" and that the "engine must have some kind of vacuum system, preferably manifold vacuum." Because diesel engines do not have an inherent vacuum source, diesel powered vehicles are often equipped with a separate vacuum pump for the purpose of operating certain accessories, e.g., power brakes. Please describe how your device functions on diesel engines.

2. You indicate that a source of manifold vacuum is required yet you suggest using the line to the distributor advance mechanism. In most cases, this line supplies ported vacuum. I suggest you revise your instructions to accommodate this inconsistency and provide information on how an air bleed in this line will not upset the calibration of the advance curve.

3. Have you tested your device on recent models which are calibrated extremely lean or are equipped with feedback carburetors?

4. Is mileage accumulation required before significant benefits are to be realized? If so, how many miles are necessary and are there residual effects if the device is disconnected or runs out of fluid?

5. Item 4 of your installation instructions states that after device installation the engine is started and "bubbles and turbulence should be forming in the reservoir," thus indicating the device is functioning properly. Considering that many vehicles incorporate a temperature valve to control the ported vacuum signal to the distributor, it may be that there will be no vacuum to your device while the engine is cold. Of course, this depends on which vacuum line is used for the device. Have you considered this potential problem?

After you have provided the additional information required above, we will assist you in developing an apropriate test plan for your device. Because you have stated the device is also applicable to diesel engines and have suggested that mileage accumulation may be necessary, these factors will weigh heavily in what the ultimate test plan will be.

So that we may conduct our evaluation in a timely manner, I ask that you submit the required information by February 11. Should you have any questions or require further information, please contact me.

Sincerely,

Merrill W. Korth

Merrill W. Korth
Device Evaluation Coordinator
Test and Evaluation Branch

United States Environmental Protection Agency
Test and Evaluation Branch
Ann Arbor, Michigan 48105

January 28, 1983

Attn: Mr. Merrill W. Korth

Subject: Hydro-Vac Unit
Your letter dated January 20, 1983

Dear Mr. Korth:

In answer to your letter, the following comments are offered.
Diesel powered cars and trucks:

1. A. On a 1981 Cadillac, the Hydro-Vac Vacuum line is connected to a vacuum line which discharges into the air intake manifold.
   B. On a 1980 Cadillac, same as A. above.
   C. On a 1980 Olds-98, same as A. above.
   D. On a 1981 Peugeot, connected to vacuum pump line which dsicharges into air intake maniflod.
   E. On 1980 Chevrolet pickup, same as A. above.
   F. On 1981 Olds Delta 88, same as A. above.

In every case, owners report a remarkable imporvement in performance, plus an increase in MPG, however the increase in MPG varies.

2. In some applications this distributor advance line is a ported vacuum, not manifold. However, on the gasoline powered cars where I installed the Hydro-Vac unit, this vacuum source was manifold vacuum. In no case has it been necessary to re-set the timing because of the Hydro-Vac vacuum line being connected to this distributor advance vacuum line. The Hydro-Vac uses only a small portion of the available vacuum on this line. I am glad you brought this to my attention as I will change the Literature to reflect this.

3. The latest model car which we have installed a Hydro-Vac on is a gasoline powered 1982 Cadillac Fleetwood Brougham. The owner reports better gas milage and inproved performance. We do not know what you mean by feed back carburetors.

4. On older gasoline powered cars where they may have accumulated, say 15,000 miles or more, it has required several tanks full of fuel to realize the full potential of the Hydro-Vac unit. For example, the first tank of fuel may show an increase of 5% to 7%; the second tank 7% to 12% the third tank 12% to 16%, ect. Apparently during this milage accumulation, carbon deposits are being removed from the spark plugs and firing chambers. Inspection of the plugs reveals this result. At some point, the increase in MPG will level off, usually some where between 15% and 25%. However, I have some owners report as high as 30% increase in MPG, and in every instance, all have reported an improvement in performance.

5. So far the accomulation of milage has not been a factor on diesel powered vehicles. The results in increase in MPG and improved performance has been immediate.

There is no detrimental effect on engine if Hydro-Vac runs out of water or mal-functions for some other reason, you just will not receive the good benefits of the Hydro-Vac.

6. The Hydro-Vac unit will work on either manifold vacuum or ported vacuum, however it will give better results when hooked up to maniflod vacuum. I will revise my literature to incorporate change in instructions in locating proper vacuum line.

A copy of my revised literature is enclosed.

Very truly yours,

James T. Griffin

JTG/rh

HYDRO-VAC SYSTEM

An adaption of water induction system used on World War II aircraft engines to increase power. Designed to increase miles per gallon and inprove performance of your car and/or truck engine. Reports indicate 10% to 20% increase in miles per gallon.

OTHER BENEFITS ARE:

1. Saves money on fuel and maintenance cost.
2. Low initial cost.
3. Lasts the life of your engine.
4. Easy to install and maintain.
5. Can be used on engines fueled with gasoline or diesel.
6. Is 100% safe.
7. Produces more horsepower from your engine.
8. Promotes more efficient burning of fuel-air mixture.
9. Reduces "dieseling".
10. Spark plugs stay cleaner longer.
11. Can be moved from one vehicle to another.

WARRANTY: You must be satisfied. Should you for any reason not be satisfied with the increase in MPG or performance within 60 days from date of purchase, return the complete HYDRO-VAC unit to your dealer for full refund of purchase price. Guaranteed against defects in material & workmanship for period of one year from date of purchase. Warrant is restricted to the replacement of the entire unit or any component part thereof. No other warranty is expressed or implied.

HOW THE HYDRO-VAC SYSTEM WORKS:
Water-air mixture is introduced into the firing chambers through the vacuum system of your engine. The fuel-air mixture of your engine is cooled by the HYDRO-VAC vapor thereby causing the fuel-air mixture to become more dense. Upon entering the firing chamber and being detonated, the expansion of the gases is greater, thereby producing more horsepower which results in more miles per gallon.

The unique regulating valve (patent pending) regulates the amount of vapor introduced into the firing chambers in the correct amount by the modulating devise which partially closes on high vacuum (low R.P.M.'s) when less fuel is required) and opens wide on moderate vacuum (higher R.P.M.'s when more fuel is required). The net result is more miles per gallon and better performance from your engine.

SOLD BY: GRIFFIN SALES COMPANY, Inc., P.O. Box 1627, Bellaire, Tx. 77401.

PRICE: _____

NAME: _____

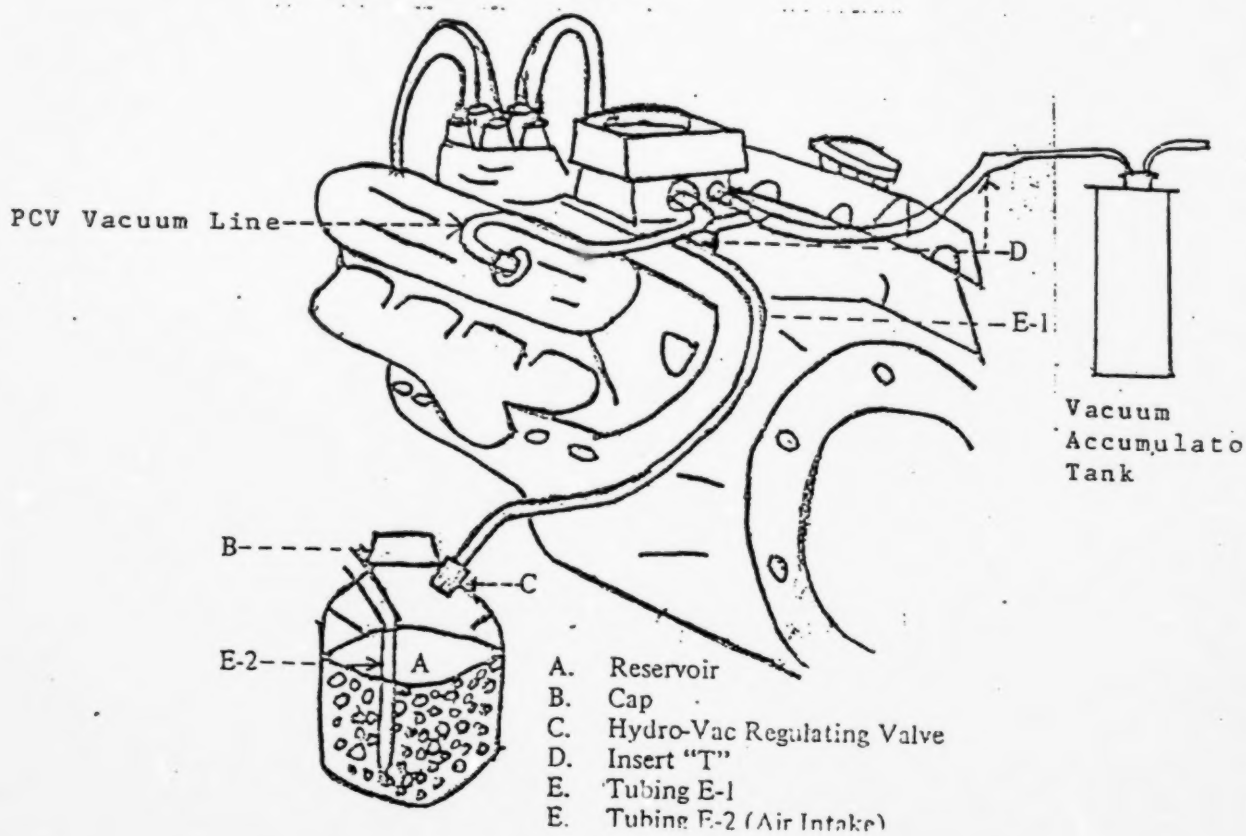
ADDRESS: _____

CITY, STATE, ZIP: _____

INSTALLATION INSTRUCTIONS: See Installation Schematic below.

1. Install reservoir (Fig.A) in suitable place in engine compartment of vechicle where reservoir will not be damaged by heat and/or moving parts such as fan belts or pulleys. Secure in a convenient place with cord provided for easy maintenance of solution.
2. Locate a manifold vacuum line source for best results. The PCV vacuum line or vacuum accumulator tank line is an excellent choice. Suggest before cutting any vacuum line, disconnect the chosen vacuum line while engine is running at idle R.P.M.'s and by holding finger over open end of line, determine for certain you have vacuum. If no vacuum is felt, replace this vacuum line and choose another. After manifold vacuum line is located, cut the line selected and insert the plastic Tee (Fig. D). Cut vacuum tube E-1 to required length and connect to Tee (Fig. D). Secure tubing from moving belts and pulleys and hot areas.
3. Remove cap and fill reservoir to fill line using approximately four (4) pints of water. Replace cap for air-tight seal. Your engine should use approximately one (1) pint of water every 400 to 500 miles, depending upon size of engine, temperature, humidity, and barometric pressure. CAUTION: DO NOT OVERFILL. Water must be below intake of the modulating valve (Fig. C).
4. Start engine and inspect reservoir. Many bubbles and trubulance should be forming in the reservoir solution and is indication that the HYDRO-VAC unit is working properly. If bubbles and trubulance do not appear in the solution, this is indication that you have no vacuum on the line or you have a vacuum leak. Check installation procedure to make certain you have vacuum and do not have a vacuum leak.
5. MAINTENANCE: Check reservoir periodically at start. When solution reaches ADD LINE, add one (1) pint of water to FILL LINE. During freezing tempreatures, add methanol or gas additive to the water to protect system from freezing.

HYDRO VAC SYSTEM
INSTALLATION SCHEMATIC



ATTACHMENT E

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

ANN ARBOR, MICHIGAN 48105

February 22, 1983

OFFICE OF
AIR, NOISE AND RADIATION

Mr. James T. Griffin, President
Griffin Sales Company, Inc.
P.O. Box 1627
Bellaire, TX 77401

Dear Mr. Griffin:

We have received your January 28 response to our preliminary evaluation and can now provide you with a recommended test plan for your Hydro-Vac device. Based on our understanding of the product, we recommend that you conduct one test program for gasoline-fueled vehicles and a second program for diesel-powered vehicles. A minimum of two randomly selected late model vehicles should be tested for each program. The four test vehicles should be selected from the list in the document entitled "Suggested Test Vehicle Engines for 511 Applicants". This listing was previously sent to you along with other test information. A copy is enclosed for your convenience. If the test results are not statistically significant, i.e., less than 6% improvement, then additional vehicles will be needed for that particular program. The device must be installed in accordance with the installation instructions intended for purchasers of the device. Adjustments to the engine parameters subsequent to those made during initial preparation of the vehicles are not permitted.

The vehicles for each program should be tested using Test Plan C and Test Sequence 4 from the enclosed test plan. Please note that at each point during the testing where mileage accumulation is indicated, each vehicle is to be driven enough miles so as to consume four tanks of fuel. This number is based on the statement in item 4 of your letter.

In item number three of your letter, you noted that you did not know what was meant by feedback carburetors. For your information, many of the recent model vehicles are equipped with computerized engine control systems which are designed to maintain an optimum balance between emissions, fuel economy, and driveability. This is accomplished by sensors, a control module, and control units. Specifically, the sensors sense various operating conditions, e.g., speed, load, temperatures, and oxygen content of the exhaust, and send a signal to the control module. The module then determines the engine parameters (e.g., air/fuel ratio, timing advance etc.) and sends a signal to the appropriate control unit. Fuel systems having these features are commonly called feedback systems.*

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*It is of interest to note that the changes in air/fuel ratios caused by some retrofit devices can be automatically negated by feedback systems. Thus, such devices may have no effect on the engine.

I am looking forward to reviewing the results of your testing. I will expect them by April 1. Should you have any questions or require additional information, please contact me.

Sincerely,

Merrill W Korth

Merrill W. Korth
Device Evaluation Coordinator
Test and Evaluation Branch

Enclosure